Cooking Time in Dry Bean and Its Relationship to Water Absorption

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Introduction. Dry beans (*Phaseolus vulgaris*, L.) require more time than most staple grain crops to cook to a point where the seeds are palatable and the protein and starch can be digested. Cooking time is a major criterion for dry bean utilization in many countries of Central America and the Caribbean where this crop is a dietary staple and firewood is the main fuel source for cooking. We conducted an experiment to develop baseline data for cooking time on an array of genotypes that have gained the interest of growers in the Dominican Republic, Haiti, and several Central American countries. Another objective was to determine if there is an association between cooking time and water absorption during soaking.

Materials and Methods. Thirty-seven accessions consisting of cultivars and breeding lines were screened for their cooking time using a 25-well Mattson drop-bar cooker. The genotypes were representative of pinto, black, red-mottled, white, kidney, pink, and small-red market classes. Twenty-five beans from each genotype were soaked for 12 hours in distilled water containing 100 ppm Ca^{++}. After they were soaked, the 25 beans were drained, dried with blotting paper, weighed, and blanched at 100°C for 30 min. in distilled water containing 100 ppm Ca^{++}. After the beans were blanched each was positioned into one of the 25 cylindrical wells of the cooker. The piercing tip of the 105g drop-bar was placed in contact with the flat surface of each bean. The cooker apparatus with the 25 beans was lowered into boiling distilled water to cook. The 25 beans of each lot were cooked until all of the bars had dropped; however, cooking sessions were terminated at the end of 3 h. The cooking time of each sample was calculated as the elapsed time from the initiation of cooking until 19 of the 25 piercing tips of the drop-bars of the instrument had penetrated the seed coat and cotyledon of seeds plus the 30 min. blanch time. The time of blanch was added to the actual cooking time of beans in the Mattson cooking apparatus because the beans were blanched in boiling water and, thus, were cooking during the blanch. The experiment was replicated 4 times. The 19th bean (75% of sample) was chosen as the cut-off for determining when a sample was cooked because this point corresponds to the sensorially preferred degree of cooking (Reyes-Moreno, 1988 cited by Castellanos et al. 1995).

Results and Discussion. Significant differences were detected among genotypes and market classes. When the cooking time was considered for individual genotypes (data not shown), MUS-N-8 was the fastest cooking (31.7 min.) while Tio Canela 75 took the longest to cook (154.6 min.). As a group (Fig. 1), pinto beans were the fastest to cook (35.8 min.), and the small-red market class genotypes were the slowest cooking (110.3 min.). We found a negative relationship (r = -0.84) between cooking time and water absorption (Fig. 2). Several studies have indicated an inverse relationship between cooking time and water absorption (Castellanos, et al. 1995; Edminster et al, 1990; Shellie and Hosfield, 1991; Elia et al, 1997). The magnitude of the regression coefficient in our study (r = -0.84) was in general agreement with the other studies. Sufficient genetic variation exists in this material to shorten cooking time through intermating and selection. Breeders in national programs where beans are a staple food would find it worthwhile to include cooking time reduction as a selection criterion in addition to yield and pest resistance. Since fast-cooking beans imbibed more water than slow-cooking ones, as indicated by the negative correlation, water absorption should be a useful

predictor of cooking time in beans. Hence, Breeders should be able to select fast cooking genotypes from slow cooking ones. Selection based on the water absorption of a breeding line as an indirect estimation of its cooking time is rapid and saves resources.

References

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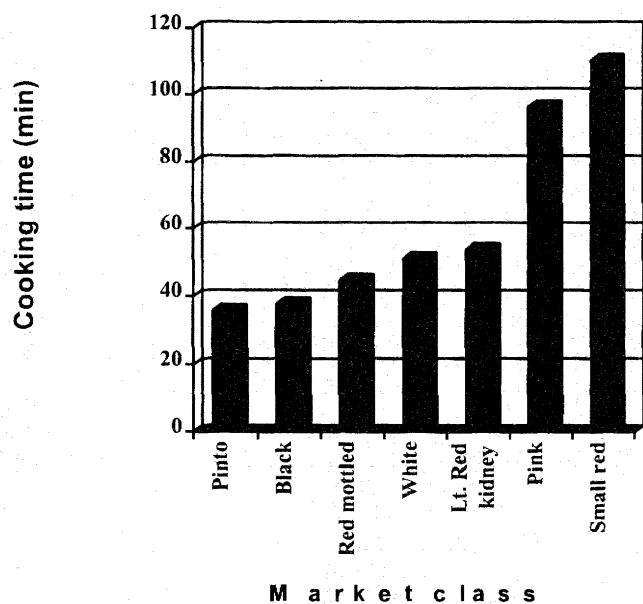
	Pinto	Black	Red mottled	White	Lt. red kidney	Pink	Small-red
Mean	35.8	37.8	44.7	51.0	53.6	96.4	110.2
Std err	1.22	1.72	1.05	1.33	1.72	1.49	1.06

Fig.1 Cooking time of 37 entries of dry bean arranged by market class. Values are averaged over the respective genotypes and replicates and indicate the mean time for 19 beans to cook.

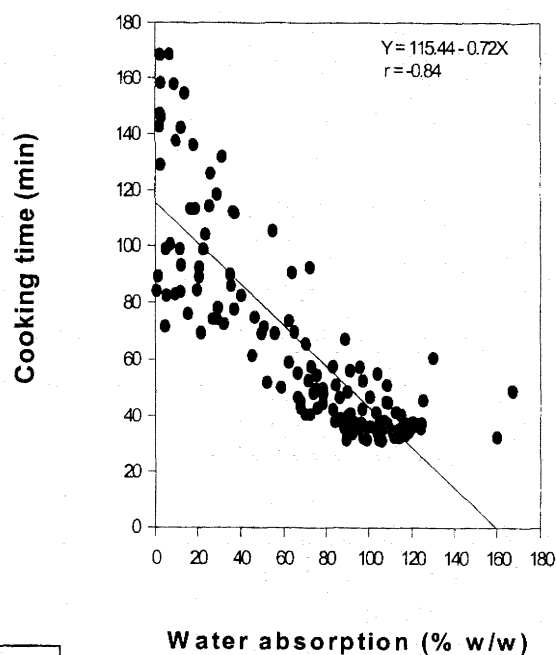Water absorption (% w/w)

$Y = 115.44 - 0.72X$
$r = -0.84$

Fig.2 Relationship between water absorption [water absorbed as %(w/w)] of dry seed and cooking time. Each point is an individual observation.